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# TOMS: THE ANTARCTIC OZONE HOLE AND OZONE TRENDS

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The TOMS instrument aboard Nimbus 7 has proved invaluable for the investigation of the recent rapid decline in the springtime total ozone over the Antarctic. We have been able to use this data to map the spatial extent of the phenomenon, discovering in the process that the decline extends beyond the polar minimum to the maximum region located at about 50 degrees south where virtually no ground-based stations are located. We have further been able to show that the minimum values of total ozone decline rapidly during September, and that this decline is accompanied by an increase in the maximum value observed. Thus, it appears that ozone is being redistributed during September via processes which appear stronger in recent years. The year-to-year decline in the integral over both the maximum and minimum may thus be due to different processes than those governing the rapid decline in September.

The principle problem which I would like to discuss is that of observing the atmosphere over long periods (decades) to determine whether or not trends and/or slow oscillations are taking place. The Antarctic ozone problem is in the process of changing our concept of the range of possible changes in the atmospheric ozone content. Because the changes were so large, as much as 40% over 7 years, and confined to a single region and season; global mapping and continued surveillance are necessary to characterize the evolving state of the atmosphere. Although a complete program to observe and identify causes for changes involves measurements of numerous parameters, I will confine this discussion to the total column content of ozone. Total ozone is an excellent summary parameter for the state of the stratosphere. It responds to temperature changes, and in the long term, is expected to respond to chemical changes. Thus, when changes take place in total ozone, such as the springtime Antarctic decrease it is a clear indication of an important problem, both because of environmental potential and scientific importance.

TOMS is actually overkill for this problem. That is, significantly more data is taken than is necessary to define the daily maps of total ozone over the globe. We have worked with the gridded data on its one degree latitude by 1.25 degree longitude grid. Tests have shown that the maps produced on a 2 degree by 4 degree grid are essentially equivalent to those produced from the entire gridded data set. We would thus be happy to trade some spatial information in favor of obtaining altitude information. Discussions seem to indicate that modification of the engineering model to measure ozone at around 10 mbar is readily doable.

Because the critical aspect of the search for changes in ozone is continuous data, reflight of a polar orbiting TOMS is important. Included in the flight should be a stratospheric temperature sensor and, if possible, a modification to obtain some ozone altitude information. A critical aspect of the problem is timeliness of the data. This has been the only drawback of the existing TOMS. We are now working with a data set which extends only through September 1983. It is expected that in the very near future the processing will be done within two weeks of real time. This is critical to the process of discovery of phenomena such as the Antarctic ozone hole. If such a system had been in place, we, rather than the British Antarctic Survey, would have discovered the Antarctic ozone hole.

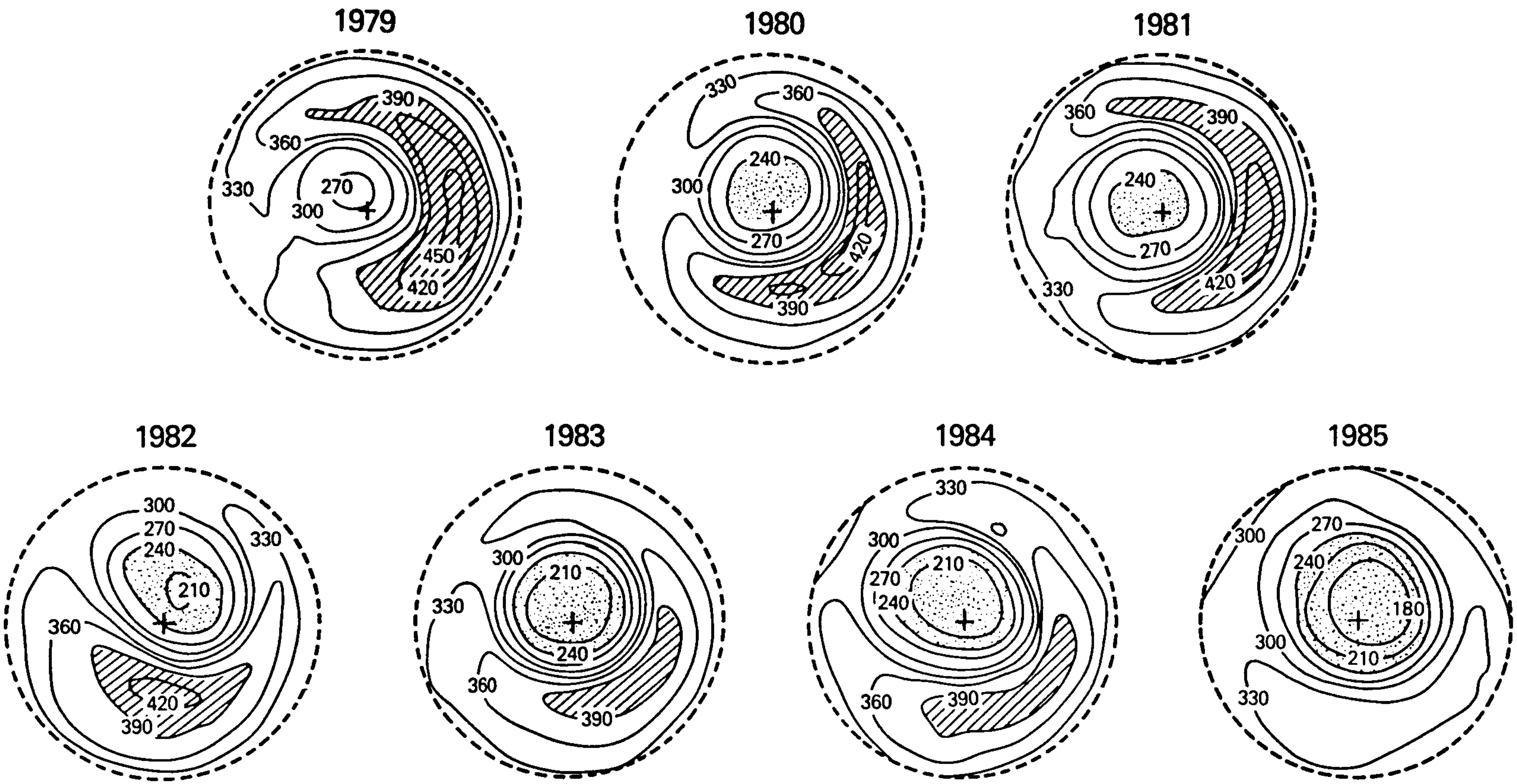


Figure 1. OCTOBER MONTHLY MEANS